BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Observations of the Voice Communications System at KSC During the Apollo 9 CDDT - Case 900

DATE: February 26, 1969

FROM: L. A. Ferrara

ABSTRACT

The performance of the voice communications system at KSC was monitored during the Apollo 9 Count Down Demonstration Test. Particular emphasis was placed on observing those portions of the test which included combinations of the on-board spacecraft voice systems with the Launch Complex 39 Astrocommunications system, the Operational Intercommunications System - Radio Frequency (OIS-RF) and the MSFN Unified S-Band ground station at MILA.

Although some operational and equipment problems were noted, voice communications were generally considered acceptable. There was a noticeable improvement in the system performance over that observed during the Apollo 9 Flight Readiness Test, particularily in the voice signal levels of the OIS-RF channels. One apparent problem area was documentation of the configuration of the MSFN ground station at KSC.

BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D.C. 20024

SUBJECT: Observations of the Voice Communications System at KSC During the Apollo 9 CDDT - Case 900

DATE: February 26, 1969.

FROM: L. A. Ferrara

MEMORANDUM FOR FILE

1.0 INTRODUCTION

Voice communications system performance on the prime operational channels was observed during the later phases of the Apollo 9 Count Down Demonstration Test (CDDT) at KSC on February 18-19, 1969. Messrs. I. J. Mason (NASA Headquarters - MOG) and J. J. Hibbert monitored voice circuits at the Audio-Visual facility of the Communications Distribution and Switching Center (CD & SC). Mr. J. T. Raleigh monitored part of the time at the Unified S-Band Station (GMIL) and the remainder of the time at the RF facility (MOLC) of the Manned Spacecraft Operations Building. The author monitored at the Communications Control Console in Firing Room 1 of Launch Complex 39. The adjacent Firing Room 2 is the prime Control Room supporting the Apollo 9 mission.

Principal coverage was accorded those portions of the CDDT which involved operational combinations of the on-board spacecraft voice systems with (1) the LC-39 Astrocommunications System, (2) the KSC Operational Intercommunications System - Radio Frequency (OIS-RF) and (3) the MSFN Unified S-Band station at MILA. This test was considered particularily important in view of the unsatisfactory performance of certain elements of the KSC voice network noted during the Apollo 9 Flight Readiness Test[1] and the subsequent special efforts which were made to rebalance the OIS-RF and reverify the Astrocommunications System.

Voice system performance was generally considered satisfactory although some operational and equipment problems were evident. The following section lists the pertinent observations made by the monitoring team during the CDDT in the approximate order in which they occurred. The time (EST) and date of the event is indicated where appropriate

---

[1] L. A. Ferrara, Bellcomm Trip Report - "Observations of Voice Communications During the Apollo 9 Flight Readiness Test" Case 900, dated February 25, 1969.

2.0 OBSERVATIONS

2.1 Wet CDDT

The spacecraft crew could not hear up-link voice on the Pad Comm (Spacecraft Umbilical) circuit during the T-9^h:30^m CSM voice checks of the wet CDDT (0703 February 19). When the cause of the problem was not immediately determined, these voice checks were rescheduled for the recycle time between the wet and dry CDDT while troubleshooting procedures were initiated. The cause of the loss of voice to the crew was found to be a loosely mounted output jack on the spacecraft interface amplifier which shorted the circuit against the metal case when a monitor recording plug was inserted. The amplifier was replaced and the trouble was cleared. It did not reoccur during the Dry CDDT. The S-Band communications with the crew sounded good to GMIL monitors at this time. VHF voice link checks were not run because of the test deferment so that the performance of this portion of the voice system was not determined.

2.2 A 1000 Hz test tone was inadvertently applied to OIS channel 111 (Space Vehicle Test Supervisor net) for 6 minutes causing annoyance but voice communications were not interrupted. (0836 February 18).

2.3 OIS channel 214 (Spacecraft Communications System Engineer NET-MCSE) was disturbed throughout the CDDT tests by short duration random noise bursts every few seconds. The noise did not cause interruption of voice communications but was annoying to monitor and was commented on by the users and the flight crew. At times,particularly when the prime operational channels were heavily monitored, the noise level approached or exceeded the voice signal level. The cause of this noise has not been firmly established but it has been suggested that it may be either (1) an OIS-RF system peculiarity by which a channel being monitored gets a pulse when an active channel is opened by a user or (2) the breaking of the voice squelch threshold by noise. The noise was similar in character to that observed on high traffice density OIS-RF channels during other missions.

2.4 Recycle Time (Repeat of Communication Test)

The voice signal from the MCSE station at the MSOB was observed to break up badly causing unintelligible communications (0040 February 19). The end instrument VOX sensitivity was believed to be at fault. MCSE changed his headset to a different OIS-RF end unit and the trouble was cleared.

2.5 A loud squeal was observed on channel 212 (CSM Test Conductor Net-MSTC) as soon as the CSM Pad Leader connected his headset to the end instrument in the White Room on Swing Arm 9. The offending circuit was quickly isolated to the pad and changing out headsets apparently resolved the problem. (0050 February 19).

2.6 A considerable amount of acoustic background noise was picked up by the spacecraft crew microphones as soon as they came on the line. A new type headset was being tried for the first time and the microphone transducer pick-up may not have been positioned properly (0144 February 19).

2.7 The spacecraft Commander (CDR) position did not seem to have as much gain on S-Band as previously experienced. The master volume thumbwheel had to be increased to position 6 instead of the usual 5 setting to give adequate volume range to the USB audio attenuator (0152 February 19).

2.8 When the MSFN station (GMIL) transmitted with constant key on VHF, a high level squeal was reported at the RF monitoring station at MOLC as well as being observed at the GMIL monitor receiver output (0205 February 19). The spacecraft, however, did not report hearing the squeal on their VHF receiver. The cause of this squeal is not known but was suggested by GMIL to be associated with their verification receiver and the constant key mode of VHF transmitter operation.

2.9 The CDR could not be heard on USB downlink when he was connected at the Astrocomm panel to OIS channel 212 (0212 February 19). GMIL reported that loss of USB down link to LC39 was due to a GMIL configuration problem.

2.10 Dry CDDT

During the Dry CDDT initial voice communications checks at crew ingress, Houston Flight was observed to be of low signal level as compared to the local KSC voice stations (~0845 February 19).

2.11 High background noise level was observed on channel 214 when the spacecraft crew reported in to the net (0923 February 19).

2.12 A loud background hum was observed on the audio circuit of channel 112 at the LC 39 Firing Room 1 monitoring position making the voice signals sound mushy, although readable. In comparison, the OIS-RF channel was clear when monitored and it is therefore believed to be a local MODEM problem at LC39.

2.13 Very loud noise was injected into channel 212 when the VHF receiver was placed on the line at about T-1 hour (1000 February 19).

Voice communications were interrupted on channel 212 on and off for a total time of about 7 minutes. When the GMIL VHF receiver output was switched to channel 214, the noise followed

causing a few more brief interruptions in voice communications (1020 February 19). The high background noise level is believed to be associated with the VHF receiver squelch settings at GMIL.

2.14 The spacecraft crew reported voice signals were loud and clear on the Astro launch circuit (1045 February 19).

2.15 During the T-15 minute communications check, LMP in the spacecraft advised that Houston Flight was breaking up badly on USB and declared the Houston link unacceptable (1048 February 19)

2.16 The spacecraft CMP could not be heard on downlink VHF at the T-15 minute voice check (1052 February 19). He was monitored loud and clear at the MOLC station but the voice signal was not being passed through the GMIL ground station. The loss of voice between the interfacing GMIL receiver output and the Astro-communications System was investigated during the T-5 minute hold for the Poseidon launch. GMIL subsequently reported that the link between the 1455 VHF receiver and the wire room at GMIL was broken. It was not considered possible to expeditiously re-establish the circuit with the model 1455 receiver and permission was granted to make the VHF circuit good using a standard ground station R278 narrow band receiver. During subsequent VHF voice checks with this receiver the CMP was observed to be slightly garbled, but readable, with considerably more background noise. It was understood that circuit measurements made at this time indicated -4 dBm average peak speech level and -10 dBm circuit noise level.

2.17 A rerun of the terminal count voice communications in the Apollo 9 launch configuration was satisfactory and the Dry CDDT progressed through a simulated liftoff at 11:54 am. Post liftoff RFI checks indicated no interference between launch vehicle and spacecraft systems. The constant key 296.8 mHz VHF carrier uplink was on for the entire RFI test.

2.18 The communications control console (AD-17) monitoring station where the author made his observations was noted to have considerably different voice signal levels. When the panel volume control was adjusted for a comfortable listening level on the audio push buttons, the OIS-RF channels were of very low level and the point-to-point circuits were so loud they caused crosstalk into the audio channels being monitored. It is understood, however, that the consoles in Firing Room No.1 were not all checked out during the re-balancing of the OIS-RF system and that this level differential problem will be corrected before this Firing Room is activated for future Mission Support.

2034-LAF-fmw

L. A. Ferrara

BELLCOMM, INC.

Subject: Trip Report - Observations of the KSC Voice Communications System During the Apollo 9 CDDT - Case 900

From: L.A. Ferrara

Distribution List

NASA Headquarters

Messrs. G. H. Hage/MA
J. K. Holcomb/MAO
T. A. Keegan/MA-2
C. M. Lee/MA
I. J. Mason/MOG
J. T. McClanahan/MOR
W. E. Miller/MOG
J. D. Stevenson/MO

GSFC

Mr. R. L. Owen/810

KSC

Messrs. R. A. Browne/SO-COM
J. E. Dowling/GUSB
A. Kempson/DE
A. J. Parrish/SO-COM-1

Bellcomm"

Messrs. W. J. Benden
C. Bidgood
A. P. Boysen, Jr.
R. K. Chen
D. A. Chisholm
J. J. Hibbert
N. W. Hinners
B. T. Howard
D. B. James
J. E. Johnson
H. Kraus
J. P. Maloy
J. Z. Menard
B. F. O'Brien
J. T. Raleigh
I. I. Rosenblum
I. M. Ross

Bellcomm

Messrs. K. H. Schmid
F. N. Schmidt
N. W. Schroeder
L. Schuchman
R. L. Selden
J. W. Timko
B. P. Tunstall
R. L. Wagner
A. G. Weygand
W. D. Wynn

Department 1024 File
Central Files
Library